Primary sarcoma of the iris : a statistical study, with the report of an additional case, in which the growth was successfully removed by iridectomy / by Clarence A. Veasey.

PRIMARY SARCOMA OF THE IRIS. A STATISTICAL STUDY, WITH THE REPORT OF AN ADDITIONAL CASE, IN WHICH THE GROWTH WAS SUCCESSFULLY REMOVED BY IRIDECTOMY.

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[Illustrated].

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[Illustrated].

Primary sarcoma of the iris is an affection so seldom met with that a report of each isolated case requires no apology. The following notes are from a very interesting case, kindly referred to me by Dr. Joseph J. Burke of this city, from whom the growth was successfully removed by a broad peripheral iridectomy.

M. B., aged 46 years, a male. had been suffering from an inflamed left eye for three weeks when I was first asked to see him at his home. There was excruciating pain in the bulb that extended backward through the temporal region to the left side of the head, accompanied by intense photophobia on the least exposure to light, which was attributed by the patient to an attack of neuralgia. An examination, however, revealed marked peri-corneal injection, a discolored iris, a contracted pupil with numerous posterior synechiæ and what appeared to be a brownish growth in the upper inner quadrant of the iris. Hot compresses at frequent intervals followed by the instillation of a solution of sulphat of atropin was the treatment prescribed, and the patient was told to report at my office on the following day for further examination.

Upon this occasion his vision was found to be for O. D. $^5/_9$ and for O. S. $^5/_{27}$, the latter eye being under the influence of a mydriatic and the patient complaining of everything looking very foggy. The vision of the left eye was unimproved by glasses. An examination of the right eye showed it to be normal with the exception of a low refractive error which, when corrected, gave him perfect visual acuity.

An examination of the left eye showed an evenly dilated pupil except up and in. In this portion there were no synechiæ, but a small brownish tumor of the iris, somewhat ovoidal in shape, could be seen, the lower end of which was pushing the posterior pigment layer of the iris downward and backward giving to the pupil the shape seen in Fig. 1. With the red reflex from the fundus as a back-

ground the position of the lower end of the growth could be distinctly observed in the pupillary space. The growth itself was not so long as the entire width of the iris, as some iris tissue seemed unaffected both on the ciliary and pupillary ends, as well as upon the sides. It had the appearance of a foreign body making a bed, as it were, in the stroma of the iris, yet entirely separated from it, and pushing before it as it grew backward, the pigment layer. No blood vessels could be detected passing over its surface nor could any hemorrhages be seen. The capsule of the lens was somewhat cloudy and there remained a ring of pigment spots where the iris had been attached.

No family history of tumors of any kind or specific personal history could be elicited. The patient had some necrosis of one of the bones of the leg many years before, which had been entirely cured. He had three healthy living children.

Upon examining a photograph of the patient taken eight years before, there was a suspicious looking shadow on that portion of the iris occupied by the growth that looked as if it might have been a dark spot. A history of two other attacks of "neuralgia," evidently iritis, during this period affords additional evidence that the growth had existed for some time, though unnoticed by any of the patient's friends or members of his family. For three weeks before my ex-

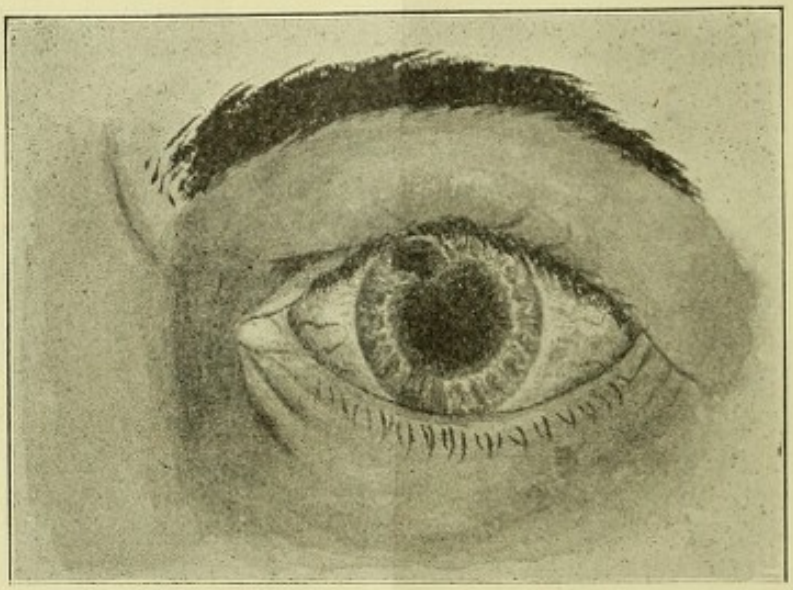

Fig. 1. External appearance of the eye showing the location of the tumor and the peculiar shape of the pupil.

amination it had been increasing rapidly in size and there was present a severe plastic iritis.

Upon consultation with Dr. George E. de Schweinitz, he agreed with me that the growth was probably a primary sarcoma of the iris, but to give the patient the benefit of the doubt, it was thought proper to administer mercurial inunctions and rapidly increasing doses of potassium iodid for a short time to see what effect might be obtained. These remedies were faithfully employed for one week, at the expiration of which time the growth was nearly twice as large as when first seen and the iritis was fully as bad, the pain still being intense, while the lens as well as the capsule was undoubtedly be-

coming opaque through the backward pressure of the lower, or pupillary end.

The growth was excised with a broad peripheral iridectomy without complication, except a profuse hemorrhage as soon as the inflamed iris was cut, a bent keratome and ordinary iris forceps being employed, there being no difficulty in drawing it out with the portion of the iris in which it was imbedded. A small tag of the iris caught between the lips of the wound giving some pain for a moment, but as soon as it was released the pain disappeared, The eye made an uneventful recovery notwithstanding iritis was present at the time of operation. The opacity of the lens continued to increase until vision was reduced to light perception when, though much clear lens substance was present, it was extracted through a three millimeter corneal flap without complication. This was about eight months after the first operation. Though the vision in the left eye before the growth was removed by the iridectomy equaled only $^{5}/_{27}$, after the extraction of the opaque lens, with the correcting glass vision equaled $^{5}/_{6}$ and Jaeger 1 was easily read. So far as can be seen

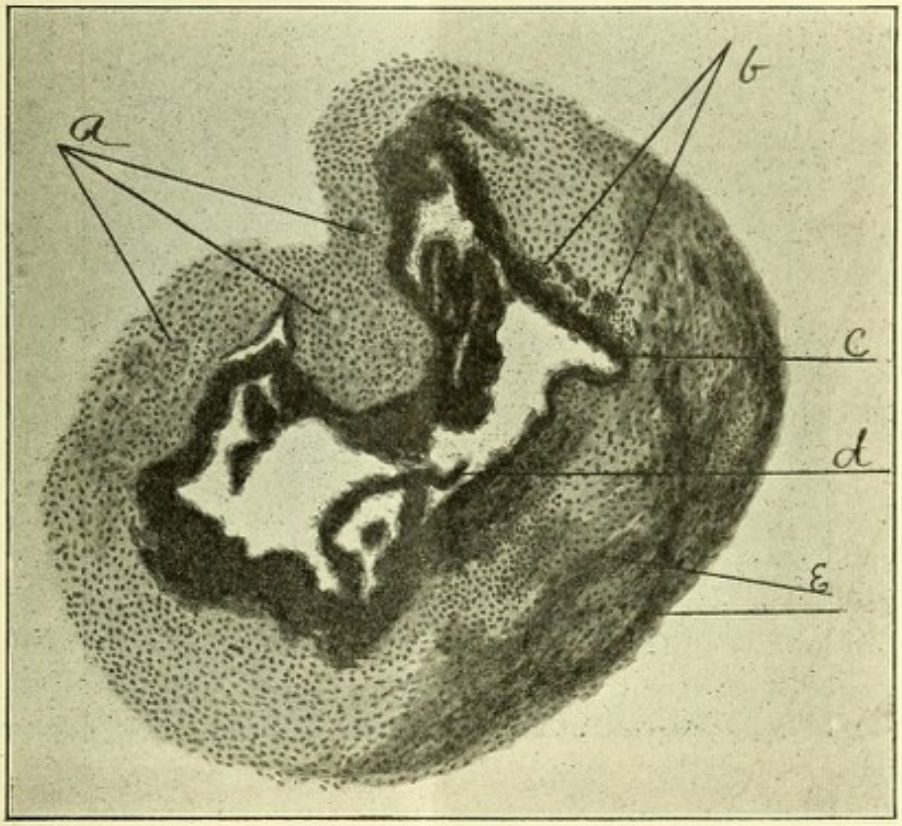

Fig. 2. Low magnification of a section of the tumor; *a*, empty blood-vessels with thickened walls; *b*, blood-vessels containing blood, the walls being composed of tumor cells; *c*, *d*, pigment layer of the iris; *e*, pigment granules.

there has been no recurrence of the disease, fourteen months having elapsed since the growth was removed.*

The tumor was somewhat crescentic in shape, being markedly concave on its inner surface and convex on its outer surface, measuring $2\frac{1}{2}$ millimeters long, $1\frac{1}{2}$ millime-

* The patient was examined a few days ago, nineteen months since the operation for the removal of the growth was performed, and no symptom of recurrence was observed.

ters broad and 1½ millimeters thick. It was hardened in Müeller's fluid, and several sections were submitted to my friend, Dr. H. F. Harris, of the pathological laboratory of the Jefferson Medical College, who kindly furnished me with the following description of the growth and superintended the drawings, which were made by Miss Elizabeth Harding:

"Four sections of the tumor were submitted to me for microscopic examination. In general outline and size they

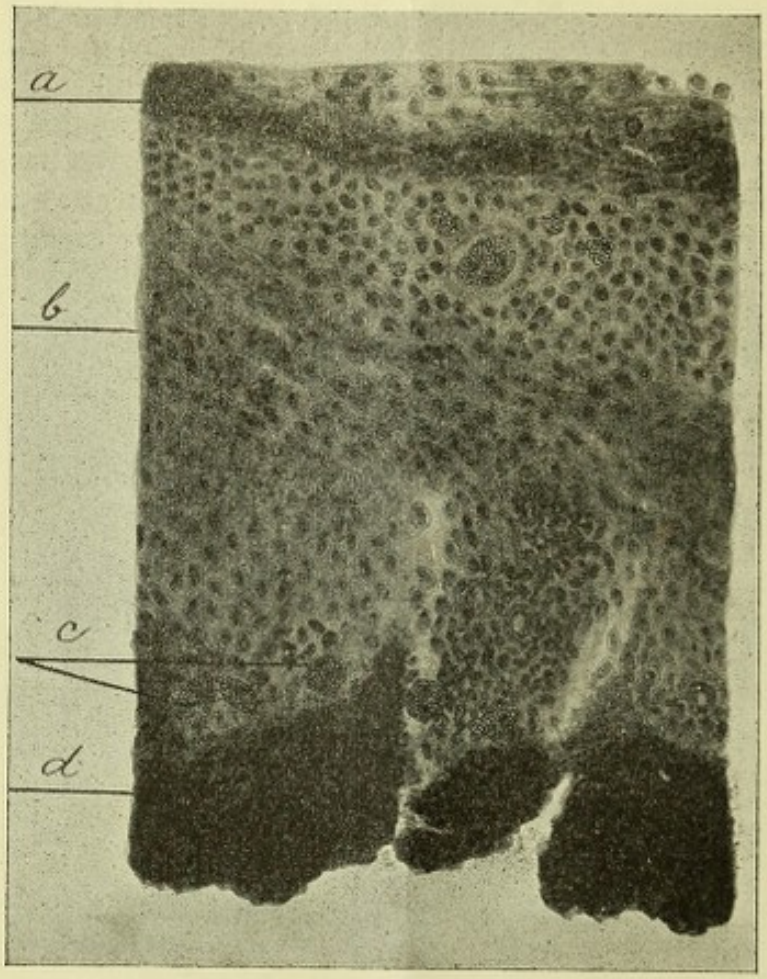

Fig. 3. Higher magnification of a section of the tumor; *a*, masses of granular pigment; *b*, bands of fibrous tissue; *c*, blood-vessels; *d*, pigment layer of the iris.

are practically identical; in form they are somewhat kidney-shaped. In the center of each is a U shaped open space (See Fig. 2) the convex border of which corresponds with the convex border of the mass. Bounding this opening and forming the inner layer of the tumor is a continuous layer of dark pigment plainly discernable with the unaided eye. The sections of the tumor given to me are thus seen to consist of an irregular but continuous ring surrounding an irregular opening. The convex portion of

this ring is more than double the thickness of the concave portion. The portion where the iris was attached is not seen in any of the preparations. This fact and the peculiar shape of the section can only be explained by the supposition that the tumor had grown forward, forming a hollow, somewhat hemispherical mass, the concave surface of which was lined by the pigment layer of the iris and that segments of this mass were cut anterior to its attachments.

"One of the sections was stained with hematoxylin and eosin and the others with carmine.

"Under a low power the tumor was seen to consist of small round cells with a considerable amount of intercellular substance. Numerous blood vessels were seen scattered through the growth. These vessels were especially numerous in the tissue forming the thin concave portion of the ring, and were remarkable for the thickness of their walls and for the fact that they contained no blood. The vessels of the thicker portions were filled with blood and so far as could be seen, had no walls, the blood being apparently in direct contact with the cells of the tumor. Numerous dark brown pigment granules were seen scattered through the tissues of the thicker portions of the ring. This was especially marked around the outer border. The pigment layer surrounding the inner border of the tumor was dark brown, almost black in color, and while continuous, was very irregularly disposed over the surface, several bands projecting into the open space in the center of the mass.

"When examined with higher powers (See Fig. 3) the cells which compose the greater part of the tumor were seen to be small round cells with which were intermingled a few oval ones. These cells were almost of uniform size, having a diameter of from 10 to 12 micro-millimeters. Their nuclei were stained of an almost solid color, both in the hematoxylin and carmine preparations, in no case being sufficiently well preserved, or stained, to show the finer details. The nuclei were surrounded by a thin rim of protoplasm in which there were often imbedded multiples of small pigment growths. In many situations, notably about the center of the thicker portions of the tumor, there is a considerable amount of firmly granular inter-cellular substance. In several places distinct bands of fibrous tissue, and minute bundles of involuntary muscular fibers can be distinguished. Most prominent along its convex border,

but scattered throughout the tumor, are numerous masses of granular dark brown pigment varying in size from immeasurably small particles to collections having a diameter considerably greater than that of the cells which compose the tumor. From the pigment layer which covers the inner surface of the tumor numerous fine spiculæ of pigment substance are seen projecting between the neighboring cells. The tumor is, however, much less pigmented here than along the outer border, and, as has been before mentioned, much of this pigment is found within the protoplasm of the cells. The inner pigment layer presents the characteristic appearance of the pigment layers of the iris.

"The tumor is, I think, beyond doubt a pigmented, small round-cell sarcoma."

During the past twenty years several analyses of the previously recorded cases of sarcoma of the iris have been published, the most extensive, however, being those of Fuchs, Andrews and Werther. In 1882, the former published his classical treatise "Das Sarcom des Uveal Tractus," in which he analyzed 16 cases that he had collected from the literature up to that time. In a recent number of the *Archiv f. Augenheilkunde*, F. Werther adds to Fuch's list twenty-three cases collected from the literature appearing between 1882 and 1893. These tables have to a considerable extent evidently been compiled from incomplete abstracts of the original reports, as many of the important details of some of the cases have been omitted in the former, but are found in the latter. In addition, some of the cases have been found to be incorrectly classed; for example, when a non-pigmented sarcoma is placed under the heading "Melanotic," and some of the cases were never operated upon, and are, therefore, useless for statistical purposes.

In the following list, a few cases recorded prior to 1893, that seem to have been overlooked in the previous papers, as well as those that have been reported from that date to the time of writing this paper (February, 1897,) have been added. No case in which the growth was not operated upon, and hence no histological examination made, has been included. Briefly, the principal points in the history of each case are as follows:

CASE I.—Adams.—A female, 13 years of age, was brought to the author with a small brown tumor about twice as large as a pin's head, situated on the lower and outer part of the left iris. While

treating with mercury the size increased and another mass appeared in the neighborhood of the first. Vision equaled $^{20}/_{50}$. Several opaque spots were observed in the deeper layers of the cornea. Enucleation was performed and the growth was found to be a round-celled sarcoma.

CASE II.—Alt.—This case was a female, 2 years of age. One month before the examination a small growth had been noticed on the right iris. The lens was cataractous. Tension at first was normal, but later became elevated. There were several nodules throughout the iris, the largest being in the lower and outer quadrant. Enucleation was performed, and the growth which originated in the parenchymatous tissue of the iris, was a round-celled sarcoma.

CASE III.—Andrews.—The patient, a female 47 years of age, had noticed discoloration of the left iris at the site of the growth for many years. The vision of this eye had been periodically obscured for fifteen months. There was no pain and the vision of each eye equaled $^{20}/_{100}$. Iridectomy was performed and was followed by suppuration of the lobe, requiring enucleation a week later. Microscopic examination showed that the entire growth had been removed by the iridectomy. There had been no recurrence eight years later.

CASE IV.—Andrews.—The patient was a female, aged 43 years. A small growth on the left iris had been observed for a long time. The tension was elevated, but the vision equaled $^{20}/_{20}$. There was some circum-corneal injection but no pain. Enucleation was performed and the growth proved to be a pigmented spindle-celled sarcoma, originating in the stroma of the iris. The canal of Schlemm was somewhat narrowed and surrounded by a collection of the spindle-shaped cells.

CASE V.—Buffum.—A female, aged 55 years, had noticed a "peculiar appearance" of the right iris for eight years. She had become blind in this eye gradually, after repeated attacks of inflammation. The last attack was present three weeks before the examination. Since then the pain had continued. There was an injected bulb and the tension was about + 2. In the upper part of the iris there was a cyst-like development involving the upper two-thirds. The lower third contained several brownish spots. The aqueous was muddy, the lens hazy, and the fundus indistinguishable. The growth was removed by iridectomy. Recurrence took place in three months. Enucleation was then performed. No recurrence had taken place at the end of eighteen months. The tumor was a spindle-celled sarcoma. The ciliary body had become secondarily involved.

CASE VI.—Carter.—The patient was a male, aged 15 years, who had noticed several small specks on the left iris for three months, and two small specks on the right iris for fourteen days. At the time of the examination there was a yellowish growth half as large as a pea in the lower and inner quadrant of the left iris and small yellowish spots at the margin of the right iris in the external half. There were small circular opaque deposits in the layers of the cornea. The tension was normal and Jaeger 1 could be read with each eye. Iridectomy was performed in the left eye, but the growth recurred.

In the right eye the spots were so enlarged nine months after the operation that only large objects could be seen. The tumor was a round-celled sarcoma.

CASE VII.—Charnley.—This patient was a male, aged 16 years. A spot had been observed on the iris eleven years before, and there had been occasional attacks of obstruction of vision from hemorrhage into the anterior chamber. At the time of the examination, there was found on the lower and inner quadrant of the iris a small brownish-gray tumor about one-twentieth of an inch in diameter. Vision equaled $^{6}/_{9}$. Recently red spots had appeared on its surface. It was removed by iridectomy, and proved to be a non-pigmented spindle-celled sarcoma.

CASE VIII.—Collins.—A male, aged 21 years, presented himself for the treatment of a brownish growth of the left iris that was situated on the inner and lower quadrant. A photograph of the patient taken four years before the examination showed a brown spot on the lower and outer portion of the iris. At the time of the operation, however, the larger portion of the growth was on the lower and inner quadrant of the iris. Vision equaled $^{6}/_{6}$ and the tension was "full." Enucleation was performed, and the growth, which was a pigmented, small round-celled sarcoma, had not recurred in seventeen months.

CASE IX.—Dreschfeld.—A female, aged 53 years, had noticed some trouble with the left iris for two and a half years. Examination showed a reddish-gray tumor about the size of a split pea in the lower part of the iris. The eye was enucleated, and the growth, which probably originated from the inter-muscular tissues of the iris, was a non-pigmented spindle-celled sarcoma. The patient was under observation for several years, there having been no recurrence when last seen.

CASE X.—Edsall.—A female, aged 23 years, had observed a small growth on the temporal side of the left iris, midway between the peripheral and pupillary margins, about two years before. At the time of the examination the growth was about the size of a split pea, covering the pupillary space, and of a dark gray color, with a smooth surface. The tension was elevated and the vision equaled $^{20}/_{30}$ through a small hole in the center of the growth. Frequent hemorrhages were observed in the anterior chamber. Although the personal and family histories were negative, mercury and potassium iodide were administered for a time, but without any beneficial result. Enucleation was performed, and the growth was a pigmented small spindle-celled sarcoma.

CASE XI.—Ewetzky.—This patient, a male, aged 38 years, had noticed some trouble with his left eye for two weeks. Examination rerevealed a growth in the posterior part of the upper half of the iris, pushing the iris forward and pressing on the lens. The tension was normal at this time but later became elevated. Vision equaled $^{10}/_{70}$. As there was a history of syphilis acquired fifteen years before, the patient was treated with mercury, but vision became reduced to the counting of fingers. Enucleation was then performed, and the growth proved to be a pigmented round-celled sarcoma.

CASE XII.—Fano.—The patient was a male, aged 19 years, who

had a small brownish growth partially filling the anterior chamber of the left eye. There was some injection of the eyeball and slight vascularization of the cornea with hypopyon. Light could not be distinguished. The cornea was perforated. The operation for stapyhloma was first performed, and a week later the stump was enucleated. The examination showed small regular pigmented cells.

CASE XIII.—Hirschberg..—The patient was a man, aged 38 years, who had noticed a dark spot on the iris of the right eye since childhood, but which had been increasing in size for one year. The visual acuity equaled $^{20}/_{30}$ and the tension was normal. At the time of the operation there was a brownish growth occupying the lower two-thirds of the anterior chamber that had originated in the lower portion of the iris. Enucleation was performed, and microscopically the growth was a pigmented spindle-celled sarcoma, probably originating from the anterior layers of the iris. There was no recurrence in six months.

CASE XIV.—Hosch.—A male, aged 66 years, had observed a brown spot on his right iris since youth. There was some injection in the lower part of the conjunctiva, but no pain. The lower part of the anterior chamber was filled with a light brown growth that was pushing the iris slightly backward and that extended almost to the center of the pupil. Externally, the margin of the tumor was well defined; internally, it disappeared into the iris stroma so that no line of demarcation could be made out macroscopically. The tension was normal and the vision, which at first equaled $^{16}/_{30}$ with a Hm. of 2 D., at the time of the operation equaled $^{16}/_{100}$. The bulb was enucleated, and the growth which was 4 millimeters thick and 7 millimeters high, was confined to the iris, and microscopically proved to be a pigmented spindle-celled sarcoma.

CASE XV.—Kipp.—A male, aged 36 years, had noticed a spot on the right iris twelve years before. For one month it had been growing very rapidly. At the time of the operation there was a whitish growth that covered a large portion of the pupil. Tension was normal and vision equaled $^{20}/_{20}$. The growth began in the lower and inner quadrant of the iris. It was excised by iridectomy, and proved to be a non-pigmented spindle-celled sarcoma, that probably originated in the iris stroma. There was no recurrence in eighteen months.

CASE XVI.—Knapp.—A male, aged 36 years, had a growth occupying about one-third of the iris that was whitish and obstructed the whole pupil when the latter was not dilated. Vision equaled $^{20}/_{70}$. Iridectomy was performed, and there had been no recurrence of the growth at the expiration of a year. The latter was a non-pigmented spindle-celled sarcoma, originating in the iris stroma without any definite line of demarcation.

CASE XVII.—Knapp.—A female, aged 35 years, had a blackish growth about as large as a pea situated in the lower part of the iris that had been present many years. During the four years preceding the examination there had been attacks of iritis and temporary increase of intra-ocular tension. At the time of the examination, however, the tension was normal and the visual acuity equaled $^{20}/_{100}$. There was some lenticular opacity that was supposed to have

been congenital. An iridectomy was performed, and the tumor, which proved to be a pigmented spindle-celled sarcoma, grew from the iris stroma without any definite line of demarcation. There were two mild attacks of iritis after the operation, but no recurrence of the growth had taken place in three years.

CASE XVIII.—Knapp.—A male, aged 22 years, had observed a small speck in his left iris ten years before. Examination showed a yellowish red growth extending from the iris into the anterior chamber, originating in the lower and outer quadrant and studded with red dots and lines. The tension was normal, although temporarily elevated at times, and the vision was $^{20}/_{20}$. The growth was removed by an iridectomy, and proved to be a non-pigmented round-celled sarcoma, originating from the iris stroma without any definite boundary line.

CASE XIX.—Knapp.—A female, aged 53 years, had observed a tumor of the upper and outer quadrant of the iris four months before the examination, that had been rapidly increasing in size. It was rather reddish and about the size of a cherry stone. The tension was normal and the vision equaled the perception of light. The eye was enucleated and the tumor, a round-celled sarcoma, was found to have originated from the root of the iris near the ciliary processes.

CASE XX.—Krükow.—A 25-year-old woman, had noticed for more than seven years a small black spot in the upper and outer quadrant of the right iris. The growth filled about one-fourth of the anterior chamber, covered half of the pupillary space, and reached to the cornea. There had been some hemorrhages into the anterior chamber, but these were always absorbed. Vision equaled $^{12}/_{30}$ (myopia $^{1}/_{36}$). Tension was normal. Iridectomy was performed for the removal of the growth, which was a pigmented sarcoma consisting of spindle and round cells. There was no recurrence in one year.

CASE XXI.—Lebrun.—A female, aged 36 years, had noticed failing vision for three months, during which time some brownish spots about the size of radish seed were observed near the external periphery of the iris. The eye was blind. After treating for a while with negative results an iridectomy was performed. Inflammatory symptoms were so great, however, that two weeks later enucleation was performed. The growth was a pigmented mixed round and spindle-celled sarcoma.

CASE XXII.—Limbourg.—This patient was a female, $7^{1}/_{2}$ years of age, whose vision in the left eye had been much reduced for fourteen days. There was slight episcleral injection and some fine lymph exudate was observed on the posterior surface of the cornea. The anterior chamber appeared to be deeper than normal. The upper and inner part of the iris was occupied by a small yellowish growth with a smooth surface, that reached to the cornea in front. The tension was elevated and vision equaled the counting of fingers at 1 M. The eyeball was enucleated, and the growth proved to be a non-pigmented round-celled sarcoma. The ciliary body and the canal of Schlemm had become secondarily involved.

CASE XXIII.—Little.—The patient, a female aged 20 years, gave the history of sudden blindness in the right eye sixteen months before, while stooping. This lasted for about one week. On recover-

ing her vision she noticed for the first time a spot on the colored part of the eye. During these sixteen months there had been three or four attacks of dimness of vision at irregular intervals, but after each attack vision had returned. These were presumed to be due to hemorrhages into the anterior chamber.

At the time of examination there was a pale brown mass about the size of a small pea in the lower and outer quadrant of the iris, that extended from the pupillary margin to the periphery. Vision equaled $^{20}/_{20}$. The growth was removed by an iridectomy, and was found to be a pigmented round-celled sarcoma. There had been no recurrence in twenty-one months.

CASE XXIV.—Oemisch.—A female, aged 42 years, had observed six years before a dark spot on the lower and inner quadrant of the iris from which there were occasional hemorrhages. During these periods the vision was markedly reduced. After a period of quiescence it began to grow rapidly. In the anterior chamber there was a dark greyish-blue mass that reached nearly to the surface of the cornea and covered a large part of the lower and inner quadrant of the iris. It was about as large as a pea and reached to the pupillary margin. Iritis had been present. Vision equaled $^{5}/_{9}$. The growth was removed by iridectomy, and was a non-pigmented spindle-celled sarcoma. There was no recurrence in four months and the patient had useful vision, being able to read "calendar figures at 6 M."

CASE XV.—Pflüger.—The patient was a female, aged 55 years, who had observed a growth upon the right iris six years before. It had been gradually increasing in size, and there was entire absence of pain. There was a history of malignant disease in the mother, originating in the naso-orbital region and extending to the globe of the eye. In the present case the cornea was normal. In the lower outer quadrant of the iris there was a dark brown tumor of irregular contour, about 3x4x5 mm. in size, extending from the periphery of the iris almost to the pupillary margin. Above the horizontal meridian there was a second smaller growth, separated from the other near the pupil by healthy iris tissue but connected with it near the periphery of the iris. The pupil was round but with mydriasis there seemed to be posterior synechiæ and opacity of the lens and capsule. Vision equaled $^{5}/_{15}$ in each eye. A broad peripheral iridectomy was performed, removing both parts, and there had been no recurrence in two years. The visual acuity remained $^{5}/_{15}$. The growth was a pigmented spindle-celled sarcoma.

CASE XXVI.—Pflüger.—In the same paper the author records a case occurring in the practice of Dr. Horner, the history of which is as follows:

A female, 36 years of age, had been aware for ten years of the existence of a small black spot on the lower quadrant of the left iris, that for a short period had been gradually increasing in size. The eyes were not inflamed, the left pupil was oval, and the growth extended from the margin of the pupil to the angle of the anterior chamber. It was removed by iridectomy, and had not recurred at the expiration of three years. The microscopic examination is simply stated to have proved the diagnosis of sarcoma to have been correct.

Case XXVII.—Quaglino and Guiata.—The patient was a female child, aged 6 years, on whose left iris there had been observed a small growth three months before. There was no iritation or severe pain. Tension equaled + 2. The patient could only count fingers, and the mass occupied about two-thirds of the anterior chamber. The parents were perfectly healthy. Enucleation was performed, and was followed by a phlegmonous inflammation of the orbit. Microscopic examination showed the growth to be a pigmented round and spindle-celled sarcoma.

Case XXVIII.—Robertson and Knapp.—A female, aged 24 years, complained of poor vision in the right eye for one year. Examination showed a brownish tumor in the upper and outer part of the iris at the ciliary margin and extending downward from this a chain of three smaller growths, still keeping to the ciliary margin. Vision equaled the counting of fingers and the tension was elevated. Enucleation was performed, and microscopic examination showed the growth to be a pigmented round-celled sarcoma with a few spindle-cells here and there. There had been no recurrence at the expiration of two years. The origin was supposed to have been from the anterior layers of the ciliary portion of the iris.

Case XXIX.—Romieé.—This patient was a female, aged 74 years, who had not seen very well since she was 40 years of age. Examination showed an irregular growth occupying the whole anterior portion of the bulb, the cornea being involved. Enucleation was performed, and the growth was a pigmented small round-celled sarcoma, that had its origin in the upper half of the iris. The retina was found detached, but the lens, choroid and sclera were unaffected. The growth had pierced the cornea in the upper part.

Case XXX.—St. John.—A male, 50 years of age, had noticed a black spot on the left iris for one year. The tension was normal and the vision equaled $^{6}/_{100}$ eccentrically inward. There was a large brown mass filling the external half of the anterior chamber and pushing the iris backward. Pressure on the cornea in front had caused a "hazy spot." The bulb was enucleated, and the growth was a pigmented spindle-celled sarcoma.

Case XXXI.—Sauer.—The patient was a female, 7 years of age. Four months before there had been observed a growth on the left iris that had been rapidly increasing in size. At the time of operation the whole stroma of the iris seemed to have been converted into a tumor mass that occupied the whole anterior chamber. Enucleation was performed, and the growth was a mixed-celled sarcoma, consisting of round, and spindle cells. No recurrence had taken ace at the expiration of three years.

Case XXXII.—Schiess.—This case is a most interesting one. A female, 55 years of age, had noticed a gradual failure of vision of the right eye for seven weeks. There were also temporary attacks of increased intra-ocular tension. At the time of examination a tumor was found in the posterior chamber pushing the iris forward. There were also seven large and small brownish spots in the ciliary region of the sclera. The eye was not sensitive nor was there any pain or iritation. The bulb was enucleated, and microscopic ex-

amination showed that the ciliary body contained a true melanoma while the growth in the iris was a pigmented spindle-celled sarcoma. The latter was supposed to have been secondary to the first and originated in the upper and inner quadrant of the iris.

CASE XXXIII.—Solomon.—A female, 43 years of age, had noticed a small brownish speck about as large as a pin's head, on the outer ciliary margin of the right iris twenty years before. It had been gradually increasing in size and growing toward the pupillary margin, which it overlapped at the time of the operation. The tension was normal and vision equaled $^{20}/_{100}$. The lens was clear but the vitreous cloudy. Enucleation was performed, and the growth proved to be a pigmented round and spindle-celled sarcoma, some cells having passed into the sclera, following the course of Schlemm's canal.

CASE XXXIV.—Tay.—A male, aged 25 years, had observed a peculiar growth on the lower half of the left iris for ten years. There was a greyish jelly-like mass covering the pupil, with opaque points scattered through it. The vision remained normal until the pupil was covered by the growth. The eye was enucleated, and the microscopic description of the growth was that of a "medullary cancer with pigment," which in all probability was a sarcoma.

CASE XXXV.—Thalberg.—The patient was a female, aged 64 years. Following the extraction of cataract and looking very much like a secondary cataract, there developed in the anterior chamber, filling the pupillary space and involving the iris, a whitish growth. The cornea became somewhat thickened, the tension was increased and vision was totally destroyed. The growth looked so much like a secondary cataract that an operation for the latter was performed. Pain persisted, however, and the growth increased in size so that enucleation was finally performed. The whole iris was found to have been involved by a non-pigmented sarcoma composed of large and small round spindle and polygonal cells. The growth had its origin in the endothelial cells of the iris.

CASE XXXVI.—Verter.—A female, 72 years of age, possessed a dark brown tumor of the right iris about the size of a hemp seed, occupying the peripheral portion of the iris and lying closely against the posterior surface of the cornea, occupying about one-third of the anterior chamber. There was present an over ripe cataract, and the eye was blind. There was no pain or irritation and the patient could give no account of the growth. The eyeball was enucleated, and sections of the tumor showed it to be a pigmented spindle-celled sarcoma. The ciliary body, the spaces of the pectinate ligament, the venous plexus, and the equator of the lens were all secondarily involved.

CASE XXXVII.—Verter.—This patient was a female, aged 60 years, who had observed some weeks before a small dark cinnamon-colored growth upon the right iris. The media were transparent and the visual acuity equaled $^{2}/_{5}$ with + S 1.50 D. The vision of the left eye was normal with + S 1.50 D. Iridectomy had been advised at the time of first observation of the growth, but at the time consent to the operation was obtained the size was so much increased that enucleation was performed. The tumor was a pigmented spindle-celled sarcoma, and had secondarily involved the ciliary body, Schlemm's

canal, Fontana's spaces, and the cornea. A small cyst was also found in the periphery of the retina.

CASE XXXVIII.—Walker.—Patient was a female aged 59 years, who had a cataract extracted from the left eye three years before without iridectomy. For a time before the examination the vision had been failing in this eye. There was no pain or inflammatory symptom but inspection showed a pinkish growth filling the pupillary space and strongly resembling secondary cataract. Discission was performed without benefit, the iris being rotten and adherent to the capsule. Three weeks later the eye was enucleated and the mass found to be a small spindle-celled sarcoma. Before enucleation the growth had extended to the cornea in front, obliterating the anterior chamber and looking very much like a large dislocated lens.

CASE XXXIX.—Webster and Van Gieson.—The patient was a female, aged 60 years. For four weeks she had seen a "purple mist" before the left eye. There was found a growth about the size of a small pea in the lower and outer quadrant of the iris. The tension was elevated and the vision equaled $^{20}/_{70}$. There was also present anterior polar cataract and edema of the retina. Enucleation was performed, and the growth was found to be a pigmented spindle-celled sarcoma.

CASE XL.—Werther.—A female, aged 72 years, had a brownish black semi-globular tumor about the size of a hemp seed in the lower and outer quadrant of the right iris. Enucleation was performed, and the growth was found to be a pigmented spindle-celled sarcoma.

CASE XLI.—Werther.—A female, aged 60 years, had observed a few weeks before, a semi-globular, brownish-black tumor of the right iris about the size of a hemp seed. There was a hypermetropia of 1.50D, and the vision equaled $^{2}/_{5}$. The growth was situated in the lower and inner quadrant. The eyeball was removed by enucleation, and the growth proved to be a spindle-celled sarcoma, part pigmented and part non-pigmented. There was also found a cyst formation in the periphery of the retina.

CASE XLII.—Whiting.—The patient was a male, aged 49 years, who had observed a spot on the left iris since 10 years of age. Several years before he had consulted Dr. Knapp and at that time the eyeball became occasionally inflamed and there were hemorrhages into the anterior chamber. At the present examination there was a dark brown growth filling the entire inner quadrant of the anterior chamber covering the inferior internal margin of the pupil, which was oblong. There were no synechiæ. The cornea was slightly hazy, from contact at several points. Vision of the right eye equaled $^{20}/_{20}$; of the left, $^{20}/_{70}$. Nine years later the patient returned on account of severe ocular pain and inflammation of the eyeball which was now totally blind. The tension was elevated. Enucleation was performed, and the growth was a pigmented mixed-celled sarcoma, the round cells predominating. The choroid had become secondarily involved and contained a true bony formation.

The case is exceedingly interesting as the growth was watched for a long time, being observed at 10 years of age, remaining harmless for twenty-five years, slowly growing for thirteen years with occasional attacks of iritis and hemorrhage into the anterior chamber,

for seven years, there being no doubt as to its malignancy. The patient refused earlier operative interference. There had been no recurrence at the expiration of six months.

CASE XLIII.—Wiegmann.—The patient was a female, aged 42 years. At birth there was observed a dark tumor about $2^1/_2$ mm. in diameter on the lower and outer quadrant of the iris, that had remained unchanged until seven months before the examination, when it began to enlarge. The tension was normal and vision equaled $^5/_5$. Iridectomy was performed, and was followed nine months later by the application of the galvano-cautery to a dark spot in the wound. This was repeated in about two weeks The tumor was a pigmented spindle-celled sarcoma, and no recurrence had been noted at the expiration of one year.

CASE XLIV.—Williamson.—This patient was a female, 14 years of age. Six months before there had been noticed on the lower and outer quadrant of the left iris a yellowish spot. At the time of the examination the growth reached to the pupillary margin, having begun in the periphery. An attempt was made to remove the tumor by an iridectomy, but this was followed three days later by enucleation of the eyeball, as the growth was found to be firmly attached by deep adhesions. Microscopic examination showed it to be a non-pigmented spindle-celled sarcoma.

CASE XLV.—Zellweger.—A female, aged 75 years, had noticed a small spot on the right iris for a long time. During the six weeks preceding the examination it had been growing very rapidly. There had been no pain or inflammatory symptoms at any time. The examination showed a pale, pinkish vascular growth in the lower part of the iris, and beginning cataract. The tension was normal and the vision equaled the counting of fingers at $2^1/_2$ M. The growth was removed by iridectomy, and was a non-pigmented small spindle-celled sarcoma, originating from the anterior layers of the iris. There was no recurrence *in situ* in six months, but as the patient had some loss of appetite the author questions whether a recurrence had taken place by metastasis. Of this there was no later proof.

Arlt refers to two cases from whom the growth was removed by iridectomy, and to a third case requiring enucleation of the eyeball. In neither were there any details of the histories, either prior or subsequent to the operations.

Fuchs, in the discussion of a paper, refers to a case of primary sarcoma of the iris for which the eyeball was enucleated, but the details of the history are too meagre to be of any use.

Cases in which primary sarcoma of the iris was diagnosed but which were not operated upon, are recorded by Berthold, Fuchs, Galezowski, von Graefe, Hasner, Owen, Pflüger, Saltzmann, St. John Roosa and Stober.

It will be seen, therefore, from the above, that there have been recorded forty-six cases of primary sarcomata of the

iris in which operative procedures have been undertaken and microscopic examinations made. Of these cases we have 14 males and 32 females, giving in round numbers, 69.5 per cent. of females, and 30.5 per cent. of males.

The ages range as follows:

From 1 to 5 years, 1 case,
From 6 to 15 years, 6 cases,
From 16 to 25 years, 9 cases,
From 26 to 35 years, 1 case,
From 36 to 45 years, 10 cases,
From 46 to 55 years, 9 cases,
From 56 to 65 years, 5 cases,
From 66 to 75 years, 5 cases.

By referring to the table it will be seen that between the ages of 15 and 25 inclusive there occurred 10 cases, and between 35 and 45 inclusive there occured 11 cases, whereas the intervening period, from 25 to 35 contained only 1 case. There seem, therefore, to be two periods during which the disease is most likely to manifest itself, namely, between the ages of 15 and 25 and between the ages of 35 and 45, with a very moderate increase of predisposition in favor of the latter period, the intervening period, that is from 25 to 35, being almost free from the affection as only 1 of the 46 cases occurred during this time. Beyond the age of 45 the predisposition decreases very gradually and, *vice versa*, the nearer we approach this age the greater becomes this predisposition.

It must be considered, however. that the above figures

NOTE.—If instead of analyzing the ages according to decades, we take five year periods, the age of predisposition can be reduced even further, still conforming with the statistics of the above tables,

From	1	to	5	years,	1 case,
"	6	"	10	"	3 cases,
"	11	"	15	"	3 "
"	16	"	20	"	3 "
"	21	"	25	"	6 "
"	26	"	30	"	0 "
"	31	"	35	"	1 case,
"	36	"	40	"	6 cases,
"	41	"	45	"	4 "
"	46	"	50	"	4 "
"	51	"	55	"	5 "
"	56	"	60	"	4 "
"	61	"	65	"	1 case,
"	66	"	70	"	1 "
"	71	"	75	"	4 cases.

It will be seen, therefore, according to this table that from 20 to 25 and from 35 to 40 years of age afford the periods of greatest predisposition. This result entirely agrees with that obtained from the first table, the former, perhaps, being slightly more accurate, as it affords a greater range.

represent in many cases the ages at which the patients were operated upon. But as the greater number of cases were operated upon shortly after coming under the observation of the various authors, and as most of them came under observation shortly after the growths in the iris were discovered, the two periods given represent quite fairly the decades of greatest predisposition.

The youngest case in the list was 2 years of age and the oldest 75 years of age, the average age being 39.3 years.

It is to be noted also that 17 of the cases occurred before the 35th year and 29 after the 35th year; or, if the 40th year be taken as the dividing line, we have an equal number on either side, namely, 23.

As to the ages when the growths were first observed to be in an active state, it is impossible to give any definite statistics. The larger number of patients consulted surgeons within a short time after the discovery of the affection but it must be remembered that many of the growths have the history of originating from apparently dark tumors of the iris, melanomata, which after remaining in a state of quiescence for many years, assumed a malignancy that microscopic examinations afterward proved to be sarcomata.

We find that the left eye has been more frequently affected, though the difference in predisposition is not marked, the actual ratio being as follows:

Right eye affected in 19 cases,
Left eye affected in 21 cases,
Both eyes affected in 1 case,
Not stated, 5 cases.

The tension is given in the histories as follows:

Normal in 11 cases,
Elevated in 16 cases,
Not stated in 19 cases.

In 5 of the cases given as "elevated" the histories state that the tension was normal as a rule, but at times elevated. Thus of those cases in which the condition of the tension is recorded we have 40.7 per cent. normal, 40.7 per cent. elevated, and 18.6 per cent. as varying, being sometimes normal and sometimes elevated. This differs somewhat from the recently published statistics of Devreaux Marshall, who has found in intra-ocular neoplasms affect-

ing the iris or ciliary body that the tension is increased in 35.71 per cent., diminished in 14.28 per cent., and normal in 50 per cent. As his cases were not, however, exclusively primary growths of the iris, but growths affecting either the ciliary body or the iris, or both, being primary and secondary, the difference may be easily accounted for. In no one of the cases of primary sarcomata of the iris was the tension stated to have been diminished.

The condition of the visual acuity in these cases ranged thus:

Normal in 9 cases,
20/100 or better, in 14 cases,
Less than 20/100 in 8 cases,
Light perception in 2 cases,
Blind in 6 cases,
Not stated in 8 cases.

In some of the cases the lens was more or less cataractous (Alt's, Knapp's, Oemisch's, Verter's, and my own). In the latter case after the extraction of the lens the patient obtained vision equal to 5/6 and easily read Jaeger 1.

The positions occupied by the tumors on the surfaces of the irides are variously given as follows:

Lower and inner quadrant, 7 cases,
Lower and outer quadrant, 11 cases,
Upper and inner quadrant, 3 cases,
Upper and outer quadrant, 3 cases,
Lower half, 5 cases,
Upper half, 3 cases,
Outer half, 2 cases,
Not stated, 13 cases.

Of the 32 definitely stated cases we have, therefore, 23 cases, or 71.8 per cent., originating from the lower half of the iris, and 9 cases, or 28.2 per cent., originating from the upper half of the iris. There also seems to be a somewhat greater predisposition to occur in the outer portion of the lower half, or in the lower outer quadrant of the iris.

The operations that were performed in the recorded cases were:

Enucleation in 32 cases,
Iridectomy in 14 cases.

In the above 32 cases under the heading "Enucleation" are included 4 cases in which iridectomy was first performed, and in which enucleation was subsequently required. In Andrews' case enucleation was performed a

week after the iridectomy because of suppuration of the globe; in Lebrun's case it was performed two weeks later because of "inflammatory symptoms" in the globe; in Williamson's case three days later because the iridectomy disclosed the fact that the growth was attached by "deep adhesions;" in Buffum's case three months later because of recurrence. In Carter's case the growth recurred, but it was so distinctly unfavorable at the time of operating that nothing else could have been expected. So that we have out of 46 cases operated upon the successful removal of the growth in 13 cases by iridectomies in which no recurrence is recorded during the time they remained under observation, which varied from four months to many years. In none of the enucleations are recurrences positively recorded, but in one (Zellweger's case) a loss of appetite with some gastro-intestinal disturbance was looked upon as probably the beginning of a metastatic process although no subsequent mention is made of it.

The histological examinations of the growths showed that

27 cases were pigmented,
10 cases were non-pigmented,
9 cases not definitely stated.

It seems somewhat odd that in a tissue so highly pigmented as the iris we should have a non-pigmented growth, yet in the 37 cases definitely recorded we have in round numbers 27 per cent. of the non-pigmented variety and 73 per cent. of the pigmented variety.

As to the cellular formation of the growths we have

23 cases of spindle-celled,
11 cases of round-celled,
7 cases of mixed-celled,
5 cases not definitely stated.

This, in round numbers places in the spindle-celled classification 56 per cent.; in the round-celled classification 27 per cent.; and in the mixed-celled classification 17 per cent. of the reported cases.

Symptoms.

From a study of the recorded cases it is seen that primary sarcoma of the iris may occur at almost any age, the youngest being 2 years, the oldest 75 years of age, the periods of greatest predisposition being between the 15th and 25th, and between the 35th and the 45th years. As a

rule it is first observed as a spot of discoloration upon the iris which, after a period of quiescence, varying from a few weeks to many years, begins to increase rapidly in size, interfering with vision according to the degree of inflammation it has caused and the amount of pupillary space covered. Vision is also sometimes obscured for short periods of time by transient increase of the intra-ocular tension or by hemorrhage from the growth into the anterior chamber. Sooner or later it is apt to produce iritis and by pressure backward to cause opacity of the capsule and lens. Tension is presumably increased when the growth attains sufficient size, or has brought about sufficiently violent inflammation to interfere with the interchange of the ocular fluids. If left to itself it attains considerable size, perforating the external coats of the eye, and usually produces blindness. It occurs twice as frequently in females as in males, each eye seems to be equally predisposed and the favorite position seems to be in the lower half, and especially in the lower and outer quadrant of the iris.

Diagnosis.

Primary sarcoma of the iris may be mistaken for simple melanoma, for gumma, or for primary tubercle of the iris.

A simple melanoma becomes darker and darker while a melano-sarcoma ordinarily retains its primary shade. A melanoma is also a congenital growth while sarcoma is not. If the patient, or patient's family, can give no accurate information on this point the growth must be watched for some time to note if there is any progress (Fuchs).

Whenever a gumma of the iris appears there is a severe iritis, whereas in the early stage of sarcoma of the iris there are no inflammatory symptoms. In gumma of the iris, also, there is a specific history with other symptoms referable to syphilitic infection. The color of the gumma is either an iron-red or deep yellowish-red, while that of sarcoma is reddish-gray, blackish or light brown, or flesh-color (Andrews). Gumma is non-vascular and yellowish-white in color at the summit, but at the base it is vascular and has a yellowish-red border (Fuchs). If the diagnosis cannot be positively made from the examination, the administration of anti-syphilitic remedies for a short time in large doses will clear up the matter.

Tubercle of the iris is of much more rapid growth than

sarcoma and in color is of a light yellowish-white, or light grayish-white, or light grayish-yellow (Andrews). As a rule no vessels are seen on its surface, whereas in sarcoma superficial vascularization can usually be detected. The larger number of cases of tubercle have occurred in subjects under 15 years of age, whereas the larger number of cases of sarcoma have been found in older persons. Tubercle is much more irregular in form than sarcoma, and the accompanying inflammatory symptoms also appear earlier.

Treatment.

If the growth is sufficiently small and does not extend to the extreme ciliary portion of the iris an attempt should be made to remove it by an extremely broad peripheral iridectomy. The statistics conclusively prove that in many cases not only has the eyeball been preserved, but with useful vision, and that no recurrence had been noted years after the removal of the growth by this operation. If the growth, however, is so large, or is situated so near the ciliary margin of the iris that it is impossible to remove all of it by an iridectomy, or if any other portion of the eye has become secondarily involved, immediate enucleation should be performed.

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